

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

(3)

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :

H03S 3/10

A1

(11) International Publication Number:

WO 96/16484

(43) International Publication Date:

30 May 1996 (30.05.96)

(21) International Application Number: PCT/US95/14258

(22) International Filing Date: 6 November 1995 (06.11.95)

(30) Priority Data:

08/339,755 15 November 1994 (15.11.94) US  
08/503,373 17 July 1995 (17.07.95) US(71) Applicant: JMAR TECHNOLOGY COMPANY [US/US];  
Suite D, 3956 Sorrento Valley Boulevard, San Diego, CA  
92121 (US).(72) Inventors: RIEGER, Harry; 17127 Pomerano Way, San Diego,  
CA 92128 (US). SHIELDS, Henry; 13770 Tres Vistas  
Court, San Diego, CA 92124 (US). FOSTER, Richard, M.;  
325 8th Street, Manhattan Beach, CA 90266 (US).(74) Agent: ROSS, John, R.; P.O. Box 2138, Del Mar, CA 92014  
(US).(81) Designated States: JP, KR, SG, European patent (AT, BE, CH,  
DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

## Published

*With international search report.  
Before the expiration of the time limit for amending the  
claims and to be republished in the event of the receipt of  
amendments.*

(54) Title: LOW COST, HIGH AVERAGE POWER, HIGH BRIGHTNESS SOLID STATE LASER

## (57) Abstract

A high average power, high brightness solid state laser system. We first produce a seed laser beam with a short pulse duration. A laser amplifier (24) amplifies the seed beam to produce an amplified pulse laser beam which is tightly focused to produce pulses with brightness levels in excess of  $10^{11}$  Watts/cm<sup>2</sup>. Preferred embodiments produce an amplified pulse laser beam having an average power in the range of 1 kW, an average pulse frequency of 12,000 pulses per second with pulses having brightness levels in excess of  $10^{14}$  Watts/cm<sup>2</sup> at a 20 micrometers diameter spot which may be steered rapidly to simulate a larger spot size. Alternately, a kHz system with several (for example, seven) beams (from amplifiers arranged in parallel) can each be focused to 20 micrometers and clustered to create effective spot sizes of 100 to 200 micrometers. These beams are useful in producing X-ray sources for lithography.